Chair of Operations Management
TUM School of Management
Technische Universität München

We are looking for (an) interested and qualified student(s) with a strong programming background to conduct a(n)

IDP / Master's Thesis / Project Study (/ Bachelor's Thesis)

on the topic:

Real-World Data Generation for Routing and Scheduling of Truck Platoons

The objective of this thesis / project is to develop a comprehensive instance set of varying sizes and characteristics for a complex routing and scheduling problem in the context of truck platooning. Truck platooning refers to the automated formation of closely spaced truck convoys, where a lead vehicle is digitally connected to following vehicles that automatically synchronize speed and braking. This concept enhances **fuel efficiency and sustainability** through reduced aerodynamic drag. Combined with higher **levels of automation** it helps mitigate the growing driver shortage by reducing workload and enabling more efficient use of personnel. As a result, platooning is considered a **key technology** for the future of sustainable and resilient logistics networks.

Building on this context, the instances should be generated using publicly available data sources, including **OpenStreetMap and the Autobahn App API**. As part of this process, the student(s) will construct multiple networks or graphs that represent (selected parts of) the German highway system. In addition, shipment requests should be derived from **real-world traffic flow data** as presented in Speth et al (2022).

The problem formulation and the underlying mathematical model are provided in a working paper by Ammann, Albinski, Crainic, and Kolisch. The thesis / project does not require the development of a new mathematical model or solution method. Instead, the focus is on instance design and on conducting a computational study using the generated instances together with the established model.

Your tasks:

- **Understand the problem and relevant literature**, the provided mathematical model and required input data.
- **Collect and preprocess publicly available data** (OpenStreetMap, Autobahn App API, traffic flow data).
- **Construct and visualize networks/graphs** representing parts of the German highway system.
- **Design and generate instance sets**, including shipment requests derived from real-world traffic patterns.
- **Conduct a computational study** using the generated instances with the established model.

Requirements:

- **Solid programming skills**, ideally in Python (for data processing, API interaction, and instance generation).
- **Basic understanding of graph theory** and network structures.
- **Familiarity with optimization models** (e.g., linear/integer programming), interest in routing and scheduling.
- Ability to work with **APIs and publicly available datasets**, including parsing, cleaning, and integrating heterogeneous data sources.
- Experience with **data visualization** or geospatial visualization tools (e.g., matplotlib, folium, QGIS) is helpful.
- Background in **Operations Research** and mathematical modeling.
- Basic knowledge of **transportation systems**, particularly road networks, is helpful.

Start date: as soon as possible
Main supervisor: Pia Ammann

Application: If you are interested in this topic, please contact Pia (pia.ammann@tum.de) directly.